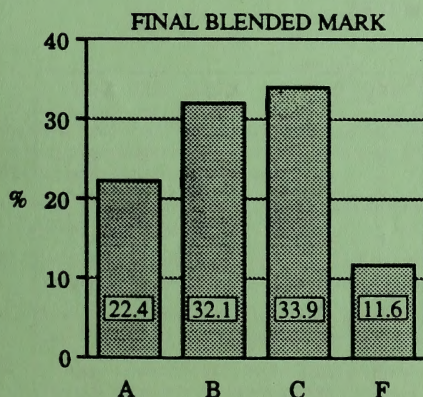
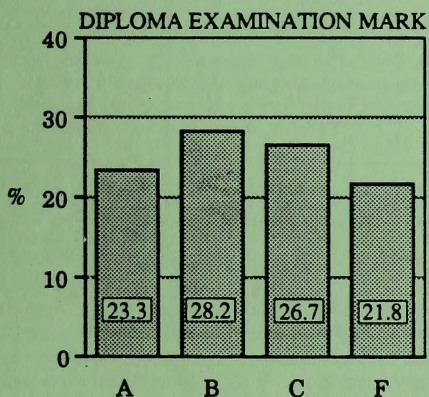
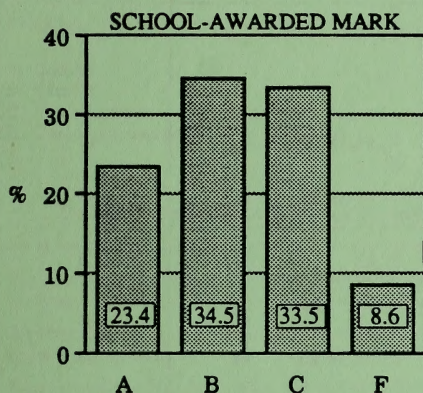


Biology 30 Diploma Examination Results



The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the June 1991 administration of the Biology 30 Diploma Examination. The information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. An annual provincial report containing a detailed analysis of the combined January, June, and August results will be available in the fall of 1991.

DESCRIPTION OF THE EXAMINATION

The Biology 30 Diploma Examination consists of two parts: a multiple-choice section of 70 questions worth 70% and a written-response section of seven questions worth 30% of the total examination mark.

ACHIEVEMENT OF STANDARDS

The information reported is based on the final blended marks achieved by 11 078 students who wrote the June 1991 examination.

- 88.4% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 22.4% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

Generally, student achievement in Biology 30 has improved. Students were better able to create solutions to problems than in previous years. Students also demonstrated a good understanding of the major concepts in human biology.

PROVINCIAL AVERAGES

- The average school-awarded mark was 67.6%.
- The average diploma examination mark was 64.5%.
- The average final blended mark, representing an equal weighting of the diploma examination and school-awarded marks, was 66.4%.

RESULTS and EXAMINERS' COMMENTS

SUBTEST

When analysing any detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Results are in average raw scores.

Machine scored: 48.0 out of 70

Written response: 16.4 out of 30

• Course Content

- Cellular Processes: 4.7 out of 7
- Homeostatic Mechanisms: 3.2 out of 5
- Nutrition and Digestion: 8.8 out of 15
- Body Fluids: 11.7 out of 17
- Breathing, Gas Exchange, and Transport: 3.5 out of 5
- Energy Release: 2.8 out of 5
- The Kidney: 6.9 out of 10
- Regulation of the Internal Environment: 13.4 out of 21
- Voluntary Movement and Body Support: 2.1 out of 3
- Human Reproduction: 7.2 out of 12

• Process Skills: 25.9 out of 45

- Multiple-choice questions 3, 5, 7, 16, 21, 27, 32, 33, 40, 42, 44, 51, 55, 57, 58, 59, 60, and 62; and written-response questions 1, 2, 3, 4, 5, and 7.

• Cognitive Levels

- Knowledge: 18.1 out of 25
- Comprehension and Application: 35.3 out of 55
- Higher Mental Activities: 11.1 out of 20

EXAMINATION BLUEPRINT

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in June 1991 according to these classifications. Numbers with square brackets [] indicate written-response questions and those without brackets indicate multiple-choice questions.

Reporting Category	Questions by Cognitive Level			Examination Emphasis (%)
	Knowledge	Comprehension and Application	Higher Mental Activities	
Cellular Processes	1, 2	3, 4, 6	5, 7	7
Homeostatic Mechanisms	8	[2]		5
Nutrition and Digestion	9, 10, 11, 12	13, 14, 15, 16, 17	[3]	15
Body Fluids	18, 20, 24, 25	19, 21, 22, 23, 27, 28, [5]	26	17
Breathing, Gas Exchange, and Transport	29, 30	31, 32	33	5
Energy Release	34		[4]	5
The Kidney	37, 39, 43	35, 36, 38, 40, 41, 42	44	10
Regulation of the Internal Environment	45, 46, 47, 54, 56	48, 49, 50, 51, 52, 53, 55, 57, [6]	58, 59, 60, 61, 62	21
Voluntary Movement and Body Support	63	64, 65		3
Human Reproduction	66, 69	67, 68, 70 [1], [7]		12
Examination Emphasis (%)	25	55	20	100

The examination has a balance of question types and difficulties. It is designed so that students capable of achieving the acceptable standard would obtain a mark of 50% or higher and students capable of achieving the standard of excellence would obtain a mark of 80% or higher. This examination is parallel in structure to the 1990 Biology 30 examinations. It is significant, therefore, that the percentage of students who achieved an A on the June 1991 examination is 23.3% compared with 18.8% of those who wrote the June 1990 examination. Correspondingly, the percentage of students who obtained an F on this examination is 21.8% compared with 29.1% of those who wrote the June 1990 examination. The number of students who received blended marks in Biology 30 this June compared with June 1990 increased by 4.6%. Approximately 11.5% of the students who wrote the Biology 30 Diploma Examination in June 1991 had written at least one other Biology 30 diploma examination during the January 1990 to January 1991 period. This subpopulation (1 276) achieved an examination mean of 57.8% compared with 64.5% for the total population (11 078). By rewriting, however, this same group (1 276) increased their examination mean score from 46.5% to 57.8%.

MULTIPLE CHOICE

QUES.	KEY	DIFF.*	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.	QUES.	KEY	DIFF.
1	B	83.7	15	A	68.7	29	C	81.0	43	A	72.4	57	B	54.6
2	A	74.5	16	A	72.1	30	A	74.9	44	B	72.2	58	C	70.7
3	D	71.1	17	C	59.4	31	B	77.1	45	B	75.3	59	D	35.9
4	D	53.6	18	B	71.7	32	B	71.9	46	A	64.1	60	C	65.0
5	B	57.0	19	B	59.8	33	D	48.0	47	D	72.7	61	D	70.0
6	C	68.5	20	B	72.4	34	A	44.0	48	C	71.9	62	B	74.7
7	D	64.7	21	C	73.6	35	B	83.8	49	B	54.8	63	A	82.2
8	C	66.9	22	C	72.3	36	D	82.0	50	D	72.0	64	B	73.1
9	D	83.2	23	D	64.4	37	A	79.5	51	D	53.0	65	B	58.6
10	A	79.1	24	C	70.3	38	A	65.6	52	C	73.8	66	B	87.9
11	B	77.9	25	D	67.6	39	B	41.5	53	A	55.5	67	A	88.4
12	B	77.9	26	A	81.0	40	C	66.3	54	A	73.6	68	B	84.4
13	D	70.8	27	D	61.0	41	B	65.4	55	D	58.4	69	A	62.9
14	C	59.0	28	D	58.2	42	C	59.7	56	D	68.3	70	C	68.3

*Difficulty - percentage of students answering the question correctly

MULTIPLE CHOICE (continued)

Students who achieved the acceptable standard demonstrated an understanding of key biological terms by identifying appropriate applications and examples (questions 3, 17, and 41). They demonstrated understanding of biological concepts by tracing pathways that materials follow in body systems (questions 38 and 43) and by sequentially ordering the major steps of a physiological process (question 52).

Students who achieved the standard of excellence demonstrated the ability to interpret interrelated sets of data presented in either tables or graphs (questions 33 and 59).

Detailed comments follow on three questions, presented in the order of increasing cognitive level.

47. Which part of the ear has the greatest influence upon body balance?

- A. Cochlea
- B. Ossicles
- C. Eustachian tube
- *D. Semicircular canals

Use the following information to answer question 70.

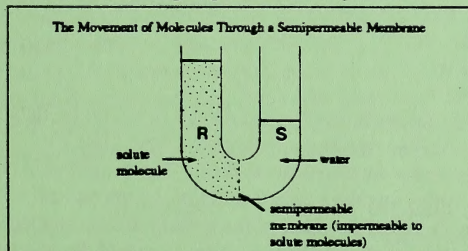
Random Order of Events in the Experimental Reproduction of Purebred Cattle

- I. Each fertilized egg undergoes cell division and the resulting cell mass is subdivided in the laboratory, producing genetically identical embryos.
- II. A purebred cow is injected with a superovulation hormone (high concentration of FSH).
- III. Eggs are removed from the purebred cow and are artificially inseminated.
- IV. Embryos are transplanted into other cows and placental formation occurs.
- V. Many follicles begin to mature.

70. An Alberta company that specializes in the breeding of purebred cattle has devised a procedure for producing many genetically identical offspring from one purebred cow. What order of events would likely result in a successful procedure?

- A. II, III, V, IV, I
- B. II, V, I, III, IV
- *C. II, V, III, I, IV
- D. III, II, V, I, IV

Use the following diagram to answer question 7.



7. The initial levels of solutions R and S were equal and then gradually changed over time to the levels shown in the diagram. What is a probable cause of this change?

- A. Water was actively transported by the membrane from solution S to solution R.
- B. More solute molecules moved from solution S to solution R, resulting in an increase in the level of solution R.
- C. The solute concentration of solution S was greater than that of solution R, resulting in an unequal movement of water.
- *D. The solute concentration of solution R was greater than that of solution S, resulting in an unequal movement of water.

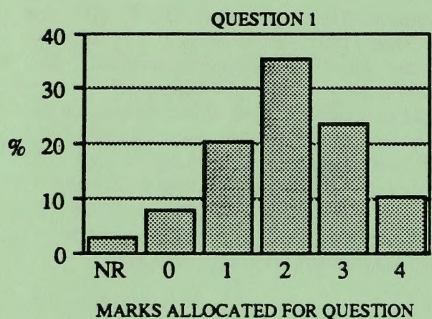
Question 47 required students to recall the functions of four specialized parts of the ear. Students also had to know that the maintenance of body balance requires sensory input transmitted by nerve tracts that originate in the inner ear. Recognition of the location in the ear of each of the four parts and their structural characteristics should have logically ruled out two alternatives. To distinguish between the cochlea and the semicircular canals required more refined understanding because both generate sensory impulses. Of the students who achieved the standard of excellence (A), 95.8% selected the correct response and only 2.0% selected parts of the middle ear. Of the students who did not achieve the acceptable standard, 41.9% selected the correct answer and 31.9% selected parts located in the middle ear.

Question 70 required students to recall the meaning of key biological terms, to understand the sequential steps in human reproduction, and then to apply their understanding to nonhuman mammalian biotechnology. This comprehension and application question was answered correctly by 92.0% of the students who achieved the standard of excellence (A) on the examination. Of the students who obtained a B or a C level of achievement, 69.4% selected the correct answer, whereas 40.5% of the students who failed the examination selected the correct answer. The most common misconceptions related to the sequence of fertilization with respect to embryo development (alternative B), and the sequence of egg and follicle formation (alternative A). Only 8% of the total population was confused about the sequence of locations for the technological procedures, i.e., cow versus laboratory (alternative D).

Question 7 required students to understand the transport processes utilized by cells and to apply these to a nonliving laboratory model. Vocabulary that has its origin in the physical sciences (solute concentration, molecule) also had to be understood. Students first had to analyse the investigative procedure and data presented. It then became possible for them to evaluate the possible interpretations provided. This analysis, evaluation, and process skill question was answered correctly by 94.2% of the students who achieved the standard of excellence (A) on the examination. Of the students who obtained a B or a C level of achievement, 63.5% selected the correct answer, whereas 36.2% of the students who failed the examination selected the correct answer. Very few students (1.0%) who achieved the standard of excellence interpreted the data in terms of active transport (alternative A). However, a significant number of students (23.0%) who failed the examination assumed that active transport can occur in a nonliving laboratory model. A significant number of students did not understand the specific meanings of solute, solution, and solute concentration. Of the students who failed the examination, 40.7% selected either alternative B or alternative C.

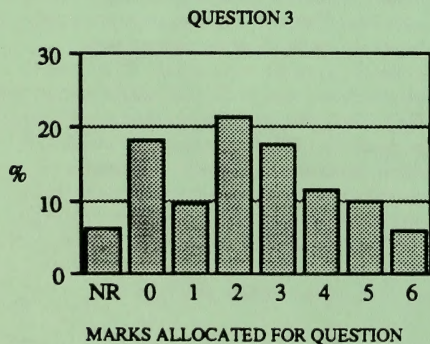
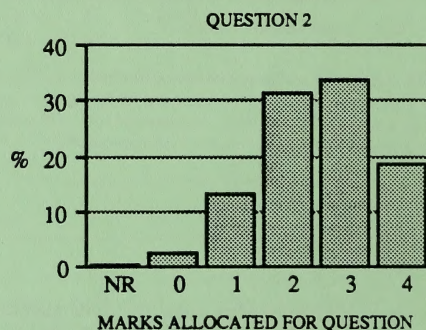
WRITTEN RESPONSE

The seven questions in the written-response section are designed to measure achievement on nine of the 10 major core concepts for Biology 30. All the questions went beyond measuring simple recall of information. Questions 1, 5, and 7 each required the integration of ideas from at least two different core concepts. Questions 1, 3, and 7 required students to apply concepts and to form predictions. Questions 2, 4, and 6 required students to interpret experimental data and generate explanations. Question 5 required students to construct a graph using data provided in two tables. The average percentage of no responses (2.8) indicates that students approached the examination with serious intent and commendable effort. The average percentage of responses that were awarded a zero mark was 9.1.



Question 1: Most students (69%) identified plausible adverse physiological effects of anabolic steroid use by both males and females. These students therefore obtained at least two out of the four possible marks for this comprehension and application question. In addition, most students (72%) who achieved the standard of excellence on the examination were able to relate the properties of anabolic steroids to the compositional characteristics of the cell membrane and/or could account for the retention of body fluid in terms of osmotic pressure. In contrast, a very small proportion (6.3%) of those who failed the examination could apply the concepts of membrane structure and/or osmosis to the properties of anabolic steroids. Too many students focused erroneously on the size of particles. Also, many students in explaining water retention in tissue focused on kidney regulation by ADH or aldosterone rather than on the concept of osmosis. On this 4-mark question, the average mark was 2.02 or 51% of the available mark.

Question 2: Most students understood the concept of experimental control as illustrated by this question. Most students also recognized that increased surface area was the cause of the vigorous reaction in test tube H. Responses to part c revealed some misconceptions about the function of enzymes. Many students confused the digestion of liver tissue by catalase with the breakdown of hydrogen peroxide. They thought of enzymes only in the context of digestion not as facilitators of other types of reactions. Some students claimed that catalase was used up in the reaction but that the liver replenished it. The majority of students did not clearly state that enzymes are reusable. Less than half (45.1%) the students who achieved the standard of excellence on the examination obtained full marks. On this 4-mark question, the average mark was 2.53 or 63% of the available mark.

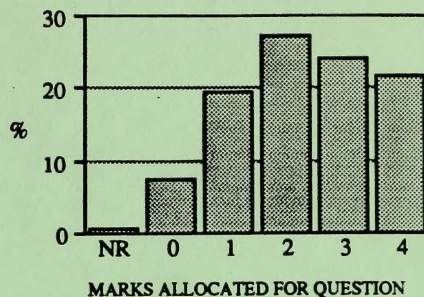


Question 3: Although 15.8% of the students obtained a mark of 83.3% or higher on this question, the majority (55.4%) received a maximum of one mark for biological concepts and one mark for communication skills. The presentation of general answers devoid of specifics was the primary cause of the low scores. Secondly, many students who identified an effect of the surgery did not support their choice with a satisfactory explanation. Other students described the normal function of the stomach but did not explain the changes that would occur as a result of the surgery. Very few students identified compensatory actions that would take place in other regions of the digestive system. A fair number of students confused gastrin with gastric juice, carbohydrates with proteins, excretion with secretion, and reabsorption with absorption. Nevertheless, examination markers did observe that student communication skills on the whole have improved over the past two years. On this 6-mark question, the average mark was 2.35 or 39% of the available mark.

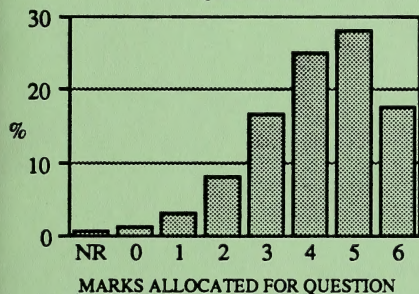
WRITTEN RESPONSE (continued)

Question 4: This question combined a selected response (part a) with a three-part created response (part b). Students who chose a wrong response to part a could still obtain one or two marks for part b, because parts a and b were not tied together. For example, if the student selected blood sample I, it was possible to provide an acceptable explanation for glucose and carbon dioxide but not for lactic acid. Most students selected blood sample III, however. Students were prone to restate data rather than provide causal relationships. If descriptions of cause-and-effect relationships were attempted, too often they were in terms of gas exchange (more CO_2 because there is less O_2) rather than in terms of aerobic and anaerobic respiration. Many students did not adequately review cellular respiration in the context of muscle function. However, 62.2% of the students who achieved the standard of excellence obtained full marks. On this 4-mark question, the average mark was 2.3 or 58% of the available mark.

QUESTION 4



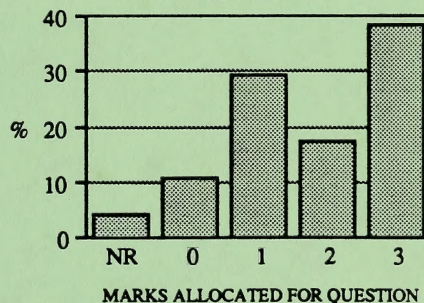
QUESTION 5



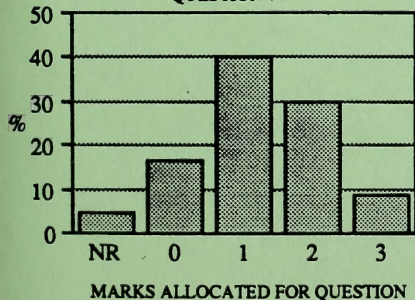
Question 5: Biology 30 student graphing skills have improved dramatically over the past several years. Of the students who achieved the acceptable standard on the examination, only 6.5% received less than three marks for this question. Responses did reveal some student uncertainties about the manipulated variable, a proper title, and the use of two scales. Most students identified the medulla oblongata as the brain region that initiates heart and breathing rate regulatory impulses. Many students limited their description of a "mechanism" to the identification of a structure or chemical. They did not include a description of the process of which the structure or chemical was a part. It was apparent that many students continue to correlate a value of one mark with a single idea (name of a structure) rather than with a complete answer. Of those students who achieved the standard of excellence on the examination, almost half (46.2%) obtained full marks. Of those who failed the examination, 1% obtained full marks. On this 6-mark question, the average mark was 4.14 or 69% of the available mark.

Question 6: This question was answered exceptionally well by those students who achieved the standard of excellence on the examination: 73.1% obtained full marks. These students recognized from the diagram that the retina produced the variations in visual perception. They had a clear understanding of the blind spot as well as the fovea. They clearly related blue color vision to the presence of cones and grey vision to the presence of rods. These students understood that the variations in perception could result from the normal function of the eye and did not necessarily suggest that the eye had defects (lens unable to focus, colorblindness). Of the students who failed the examination, 85.9% obtained one mark or less because they could not interpret the diagram and data. They also lacked sufficient understanding of the role of the retina in visual perception. On this 3-mark question, the average mark was 1.79 or 60% of the available mark.

QUESTION 6



QUESTION 7



Question 7: The students who achieved the standard of excellence on the examination found this question to be the most difficult of the seven; 26.2% obtained full marks. The inability of students to express themselves accurately and descriptively cost them marks. Their incorrect use of key terms such as secretion, excretion, ejaculation, sperm, and semen communicated erroneous concepts. Most students who obtained a B or a C level of achievement on the examination responded in generalities and did not address the "how" question. These students also had difficulty distinguishing between quantity and quality. It was apparent from answers to part a that most students could easily identify the prostate gland in the unlabelled diagram. However, most of these same students did not understand the gland's function, as was evident from their responses to part b. On this 3-mark question, the average mark was 1.27 or 42% of the available mark.

For further information, contact Lowell Hackman, Yvonne Johnson, or Phill Campbell at the Student Evaluation Branch, 427-2948.

